ENERGY STAR with INDOOR AIR PACKAGE PILOT SPECIFICATIONS

September 30, 2005

The following specifications have been developed by the U.S. Environmental Protection Agency (EPA) to recognize homes equipped with a comprehensive set of indoor air quality measures. Homes that comply with these specifications can use "***Indoor Air Package***" as a complementary label to ENERGY STAR for homes. ***As a prerequisite for this label, a home must first be ENERGY STAR qualified.*** These specifications are being released for this pilot to only a limited number of markets identified by EPA. This is because EPA wants to avoid widespread dissemination of these specifications before anticipated refinements can be made following an evaluation of this initial pilot. EPA believes the need for refinements is virtually assured based on the substantial scope and complexity of these specifications. To identify these refinements, EPA will actively monitor and evaluate the pilot markets regarding a number of key factors including reasonable cost, strength and fairness of technical underpinnings, compatibility with production builder practices, and enforceability. It is anticipated that EPA will revise these specifications based on results from the pilot markets and expand the label to new markets sometime in 2007.

EPA intends that the construction practices and technical specifications that comprise the ENERGY STAR Indoor Air Package are designed to contribute to improved indoor air quality in new homes compared to standard code-built homes. However, these measures alone will not guarantee that homebuyers will not experience air quality problems in their homes. Rather, the Indoor Air Package should be viewed as a way to reduce the likelihood of experiencing such problems. For example, factors such as unforeseen construction issues and homeowner behavior may negatively impact the home's indoor air quality and the performance of the measures specified in the Indoor Air Package

1. Moisture Control Required Measures		Reference(s)
Water Managed Roofs		
1.1	Provide minimum No. 30 roof felt underlayment or equivalent.	• Copper Development Assn. Design Handbook, Sect. 4
1.2	In IECC 2004 Climate Zones 5 and higher, provide self-sealing water protection membrane ice flashing over the sheathing at the eave extending 2 feet inside the exterior wall plane.	• Moisture Control Handbook • IRC
1.3	Provide metal drip edge at all exposed roof decking.	• NAHB Green Home Building Guidelines
1.4	Provide self-sealing bituminous membrane or equivalent at all eaves, valleys and penetrations except in climates with less than 20 inches annual rainfall.	•
1.5	Provide insulation wind baffle or other air barrier to block wind washing at all attic eave bays in roof assemblies with soffit vents.	• EBBA Builder Guides • Moisture Control Handbook
1.6	Provide step flashing at all intersections of roof and walls with the exception of continuous flashing at metal and rubber membrane roofs. Metal "kick-out" flashing shall be provided at the end of roof/wall intersections to direct water away from wall. Drainage plane above shall be direct water flow onto and not behind flashing. Intersecting wall siding shall terminate a minimum of 2 inches above roof.	• EEBA Builder Guides • EEBA Water Management Guide
1.7	Direct roof water from house with either: • Guttering and downspouts shall empty to lateral piping that deposit(s) water on finish grade a minimum of 5 ft. from foundation, or in limited spaces, deposit to underground catchment system that carries water 10 ft. from foundation. • In dry climates with less than 20 inches annual rainfall as shown in EEBA Builder Guides, provide minimum 18" roof overhangs that deposit water to grade sloped away from home.	• HUD/NAHB spec for gutters and downspouts • IRC Code 801.c • EEBA Builder Guides
Water Managed Walls		
1.8	Provide drainage system (e.g. flashing or equivalent) at the bottom of all wall cladding to direct water away from drainage plane. Include weep holes for masonry veneer and weep screed for stucco cladding systems, per manufacturer specifications.	• EEBA Water Management Guide • EEBA Builder Guides
1.9	Install continuous drainage plane fully sealed at all penetrations that directs water away from all wall assemblies with either: • monolithic weather resistant barrier (e.g., house wrap) sealed or taped at all overlap joints, top, and bottom. • weather resistant sheathings (e.g., faced rigid insulation) fully taped at all "butt" joints, or • lapped shingle-style building paper or felts.	• EEBA Builder Guides • EEBA Water Management Guide
1.10	Fully flash all window and door openings, including pan flashing at sills, side flashing that extends over pan flashing and top flashing that extends over side flashing.	• ASTM 2112 • EEBA Builder Guides • EEBA Water Man. Guide
1.11	All deck ledger boards shall be attached to homes with either: • minimum 3/8 inch spacers and full flashing shingle fashion from drainage plane to over framing; or • adhesive membrane strip taped to drainage plane running over ledger board and folded around joists over hanger with adhesive membrane cap patch over each joist.	• EEBA Water Management Guide
Attic/Ceiling Interface		
1.12	Recessed lights in insulated ceilings must be insulated-can, airtight (ICAT) rated with trim foam sealed to ceiling if no gasket provided.	• IECC 2004 section 402.4.3
1.13	Provide complete air barrier and sealing between attic and conditioned space including at chases, penetrations, open wall cavities, dropped ceilings, and soffits.	• EEBA Builder Guides • EEBA Water Management Guide

1. Moisture Control Required Measures (continued)		Reference(s)
Water Managed Foundations		
1.14	Slope garage floor toward main vehicle entry doorway min. 1/8 inch per foot.	• International Residential Code (IRC), R309.3
1.15	Seal all plumbing, electrical, and other penetrations of walls and floors, and joints between building materials with polyurethane caulk or equivalent.	• EEBA Builder Guide
1.16	Sump pump covers shall be air sealed (e.g. mechanically attached with full gasket seal or equivalent.)	• EEBA Builder Guide
1.17	Surface water management shall be provided as follows: • Final grade shall be back-fill tamped to accommodate settling and be sloped away from the foundation ½ inch per foot within the first 10 feet. Where setbacks limit space to less than 10 feet, provide swales or drains designed to carry water from foundation. • Patio slabs, walks and driveway shall be sloped ¼ inch per foot away from house.	• IRC R461.3 • IRC R401.3
1.18	Capillary break shall be provided at all concrete slabs: • 4 inch bed of ½ inch diameter or greater clean or washed gravel, covered with minimum 6 mil polyethylene sheeting in direct contact with the concrete slab, lapped minimum of 12 inches at joints; or alternately • A minimum 4 inch uniform layer of sand, overlain with a layer or strips of geotextile drainage matting, covered with polyethylene sheeting lapped minimum of 12 inches at joints. **Exceptions**: • In areas with free-draining soils, identified as Group 1 in the International Residential Code by a certified hydrologist, soil scientist, or engineer through a site visit, a gravel bed or geotextile matting is not required. • 6 mil polyethylene sheeting is not required in climates with less than 20 inches annual rainfall.	• EEBA Builder Guides • EEBA Water Management Guide • IRC, Appendix F, AF103.3 Soil Gas Retarder • IRC, Table R405.1, Unified Soil Classification System • IRC R506.2.3, Vapor Retarder
1.19	Exterior surface of below grade walls shall be finished as follows: • poured concrete, concrete masonry and insulated concrete forms with damp proofing coating; • wood framed walls with trowel-on mastic and polyethylene, or equivalent water proofing	• NAHB Green Building Guide
1.20	Provide drain tile at footings, level or sloped to discharge to outside grade (daylight) or to accessible sump pump. Top of drain tile pipe must always be below level of where bottom of concrete slab or crawl space floor will occur. Pipe shall be surrounded with min. 6 inches of ¾ inch washed or clean gravel that is fully wrapped with fabric cloth.	• EEBA Builder Guides
1.21	All crawl spaces shall be unvented and conditioned. Crawl space floor shall be either: • Soil covered with 6 mil. polyethylene (10 mil. recommended) lapped 12 inches and attached to walls and piers with adhesive and furring strips; or • Concrete slab over lapped polyethylene and gravel. Crawl spaces also shall be fully sealed to prevent outside air infiltration and be provided with conditioned air at a rate not less than 0.02 cfm per square foot of horizontal area. Complying with any of the following meets this requirement: 2003 International Mechanical Code, section 406.1; 2003 International Building Code, section 1203.3.2; or 2004 Supplement to the IRC, section R408.3. **Exceptions:** • Marine climates as defined by IECC 2004 Climate Zone map • Raised pier foundation with no walls	• 2004 Supplement to the IRC, Section R408.3 • IMC, Section 406.1 • IBC, Section 1203.3.2

1. Moisture Control Required Measures (continued)		Reference(s)
1.22	Insulate exterior walls with International Energy Conservation Code (IECC) specified R-value; do ***not*** install a vapor barrier on interior or living space side of wall (note that semi-vapor permeable rigid insulation is not considered a vapor barrier). **Exception**: Follow restrictions of IRC R320.4 of the International Residential Code, "Termite protection and prohibition of foam plastics" regarding use of foam insulation on the exterior of foundations.	• IECC • EEBA Builder/Water Man. Guides • IRC Section R320.4 • IRC Figure R301.2(6), Termite Infestation Map

2. Radon Control Required Measures		Reference(s)
Radon Resistant Construction		
2.1	The U.S. EPA radon area shall be identified for each home by consulting U.S. EPA Radon Zone Maps or contacting the State Radon Coordinator through the state health office.	• *http://www.epa.gov/iaq/radon/ zonemap*
2.2	All homes in U.S. EPA Zone 1 radon areas shall be constructed with Radon-resistant features. Complying with any of the following meets this requirement: National Fire Protection Association (NFPA) 5000 "Building Construction and Safety Code", 2003 Edition, Chapter 49; International Residential Code (IRC), Appendix F; or Council of American Building Officials (CABO) "One and Two Family Dwelling Code", 1998 Edition, Appendix F.	• U.S. Environmental Protection Agency guidance document entitled "Building Radon Out", document #EPA/402-K-01-002, available through EPA's web site: www.epa.gov/iaq/radon/pubs
2.3	All homes in U.S. EPA Zone 2 radon areas are highly recommended to be constructed with Radon-resistant features. Complying with any of the following meets this recommendation: National Fire Protection Association (NFPA) 5000 "Building Construction and Safety Code", 2003 Edition, Chapter 49; International Residential Code (IRC), Appendix F; or Council of American Building Officials (CABO) "One and Two Family Dwelling Code", 1998 Edition, Appendix F.	• U.S. Environmental Protection Agency guidance document entitled "Building Radon Out", document #EPA/402-K-01-002, available through EPA's web site: www.epa.gov/iaq/radon/pubs

3. Pest Management Required Measures		Reference(s)
3.1	Foundation and wall construction shall be as follows in areas subject to termite infestation, as identified by the International Residential Code Termite Infestation Map ("Moderate to Heavy" or "Very Heavy" areas), and by determination of State Department of Agriculture or equivalent local authority: • Foundation walls shall be solid concrete or masonry with top course of solid block, bond beam, or concrete-filled block. • Foundation walls shall be capped with un-interrupted termite shield or equivalent physical barrier (e.g. flexible flashing, mesh, or rubber membrane) that extends a minimum of ½ inch beyond the interior and exterior sides of the wall, before installation of the sill plate. • Construct all interior concrete slabs with 6" x 6" welded wire fabric or equivalent, and concrete walls with reinforcing rods to control cracking. • Sill plate shall be of preservative-treated wood.	• IRC R320.4, Figure R301.2(6) • National Pest Management Association • EEBA Builder Guides
3.2	Provide rodent and corrosion proof screens (e.g., copper or stainless steel mesh) for all openings that cannot be fully sealed and caulked (e.g., clothes dryer vents).	• EEBA Builder Guides
3.3	In areas subject to "very heavy" termite infestation as indicated by International Residential Code: • Foam plastic insulation shall not be installed on the exterior face of below-grade foundation walls, or under slabs. • Foam plastics installed on the exterior of above-grade foundation walls shall be kept a minimum of 6 inches above the final grade and any landscaping bedding materials, and be covered with moisture resistant, pest-proof material (e.g., fiber cement board, galvanized insect screen at bottom-edge of openings). • Foam plastics applied to the interior side of conditioned crawl space walls shall be kept a minimum of 3 inches below the sill plate and a minimum of 2 inches above the floor of the crawl space.	• IRC R320.4, Figure R301.2(6) • National Pest Management Association

4. HVAC Systems Required Measures		Reference(s)
Ductwork		
4.1	Duct system shall be sized, designed, and installed using latest ANSI/ACCA Manual D.	• Air Conditioning Contractors Association Manual D
4.2	Ductwork shall be sealed with either or combination of: • mastic systems that meet the applicable requirements of UL181a, or UL181b, or • aerosol sealant closures meeting UL 723, • or gasketing systems.	
4.3	Ductwork shall not be installed in garage.	
4.4	Maximum leakage to outdoors shall be no greater than 3 CFM per 100 s.f. floor area, as measured by the duct pressurization method at 25 Pascals or other standard duct testing method. Total system leakage test is also acceptable, when conducted according to ASTM E1554-03. **Note:** • Leakage to outdoors of no more than 5% of rated fan flow is an acceptable alternative test measure.	• IECC 2004 • National HERS Accreditation Standards (RESNET) • ASTM E1554-03 Standard Test Methods for Determining External Air Leakage of Air Distribution Systems by Fan Pressurization
4.5	Building cavities shall not be used as part of the forced air supply or return system.	• EEBA Builder Guides
4.6	Transfer grills or jump ducts shall be provided for any closed room without a return grill except for baths, kitchens, closets, pantries, and laundry rooms. Opening size shall be 1 square inch capacity (grille area) per CFM of supply (including free area undercut below door as part of the area).	• EEBA Builder Guides • U.S. DOE Building America www.eren.doe.gov/buildings/building-america
4.7	Supply and return duct boots shall be covered during heavy dust-creating construction activities with "duct mask" or similar sheeting to keep ductwork clean.	
Heating and Cooling Equipment		
4.8	Heating and cooling design loads shall be determined per latest ACCA Manual J with heating and cooling equipment sized based on these design loads using latest ACCA Manual S.	• Air Conditioning Contractors Association Manuals J and S
4.9	Drain pans shall be sloped, corrosion resistant (e.g. stainless or plastic) with drains at the low point. Condensate lines shall be drained to drainage system; ***not*** just deposited under slab.	• IRC
4.10	HVAC cabinet seams, and all seams of plenums and duct work adjacent to the cabinet shall be sealed with mastic, and cabinet doors shall be gasketed.	
4.11	Cooling equipment shall have a maximum sensible heat ratio (SHR) of .70 in "hot humid" climates defined by International Code Council unless the home is equipped with additional whole-house dehumidification.	• IECC 2004 Climate Zone Map • ASHREAE Journal 1/03, "Latent Performance of Unitary Equipment"
4.12	Air handling equipment shall not be located in garages.	
4.13	Outdoor and indoor coils shall be sized to match per manufacturer requirements.	
4.14	Heating and cooling equipment shall only be used during construction after specified filter is installed.	
4.15	No equipment is permitted that intentionally produces ozone as a product rather than as an incidental by-product.	

4. HVAC Systems Required Measures (continued)		Reference(s)
Ventilation		
4.16	Provide mechanical whole-house ventilation meeting ASHRAE 62.2-2004. Note, as per ASHRAE 62.2, that outdoor air ducts connected to the return side of an air handler shall be permitted as supply ventilation only if manufacturers' requirements for return air temperature are met (e.g., "air shall be tempered to maintain minimum 60 degree F continuous air flow across furnace heat exchanger") In addition, whole-house ventilation for "***warm-humid***" climates as defined by the International Code Council shall also include either: • controls that ensure humid outdoor air is not supplied above the minimum rate specified by ASHRAE 62.2 while indoor relative humidity exceeds 60 percent; or • whole-house dehumidification system that is capable of removing moisture even in the absence of a demand for sensible cooling; or • enthalpy exchange equipment (e.g., energy recovery ventilator)	• ASHRAE 62.2-2004, ASHRAE Standard, Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings (section 4) • International Code Council Climate Zone Map: Proposal for 2003/2004 Code
4.17	Provide mechanical spot ventilation (e.g., bathrooms and kitchens) meeting ASHRAE 62.2-2004. In addition, all bathroom ventilation fans shall be ENERGY STAR qualified unless multiple bathrooms exhausted with a multi-port fan.	• ASHRAE 62.2-2004 (5)
4.18	All clothes dryers shall be vented to outdoors.	• ASHRAE 62.2-2004 (6.3)
4.19	Locate all outdoor air intakes for ventilation at least 10 feet away from exhaust outlets and areas where vehicles may be idling.	• ASHRAE 62.2-2004 (6.8)
Air Filtration		
4.20	HVAC filters shall be rated MERV 8 at 295 feet per minute (or higher MERV rating) according to ASHRAE 52.2-1999. HVAC equipment shall be able to accommodate pressure drop from filter selected for the system.	• ASHRAE 52.2-1999
4.21	There shall be no visible bypass between the filter, the filter rack, and the blower housing. The filter rack shall be designed to ensure that the air leaving side of the filter is in complete contact with the rack whenever the fan is running, by fitting the filter rack with neoprene gasket material on the air leaving side of the filter.	
4.22	Central vacuums, where provided, shall be vented outdoors.	

5. Combustion Systems Required Measures		Reference(s)
Combustion Appliances		
5.1	Combustion fueled equipment ***located in conditioned spaces***: • In IECC 2004 Climate Zones 4 or higher, gas-fired furnaces/boilers shall be direct vented and oil-fired furnaces/boilers shall be power vented or direct vented. • Water heaters shall be power vented or direct vented. Note: this requirement also applies to water heaters installed in attached garages, if the garage is air-sealed to the outside (i.e. for intended use as a workspace.)	• IECC 2004 • Consumer Product Safety Commission • EEBA Builder Guides
5.2	Fireplaces and Solid-Fuel Burning Appliances shall be vented to the outdoors, and provided with adequate combustion and ventilation air in accordance with ASHRAE 62.2-2004 (6.4) requirements. The following additional requirements also apply, as appropriate: • **Masonry fireplaces** are not permitted, with the exception of masonry heaters, as defined by the American Society for Testing and Materials Standard E-1602, and the International Building Code, 2112.1. • **Factory-built, wood-burning fireplaces** shall meet the certification requirements of Underwriters Laboratory UL-127, "Standard for Factory-Built Fireplaces," and meet the emission limits in U.S. EPA Standard 40 CFR Part 60, subpart AAA, 60.530-539b, "Standards of Performance for New Residential Wood Heaters." • **Natural gas and propane fireplaces** shall be power vented or direct-vented, as defined by 3.3.108 of the National Fuel Gas Code, have a permanently fixed glass front or gasketed door, and comply with the American National Standards Institute, ANSI/Z21.88/CSA 2.33 Harmonized Standard, "Vented Gas Fireplace Heaters" of the International Code Council's International Fuel Gas Code. • **Wood stove and fireplace inserts** as defined in Section 3.8 of Underwriters Laboratory UL 1482, "Standard for Safety, Solid-Fuel Type Room Heaters," shall meet the certification requirements of that standard, and meet U.S. EPA Standard 40 CFR Part 60, subpart AAA, , 60.530-539b, "Standards of Performance for New Residential Wood Heaters," and Washington State's particulate air containment emission standard, WAC 173-433-100 (3). • **Pellet stoves** shall meet the requirements of the American Society for Testing and Materials (ASTM) E 1509-04, "Standard Specification for Room Heaters, Pellet Fuel-Burning Type." • **Decorative gas logs** as defined in K.1.11 of the National Fuel Gas Code are not permitted. • **Un-vented combustion appliances** are not permitted, with the exception of kitchen-type cooking devices with exhaust ventilation meeting ASHRAE 62.2-2004 (5).	• ASHRAE 62.2-2004 (6.4) • ASHRAE 62.2-2004 (5) • ASTM E-1602 • IBC, Section 2112.1 • EPA standard 40 CFR Part 60, subpart AAA, 60.530-539b, Stds. of Performance for New Residential Wood Heaters • UL-127, "Standard for Factory-Built Fireplaces" • National Fuel Gas Code Section 3.3108 • ANSI/Z21.88/CSA 2.33 Harmonized Standard • UL 1482, "Standard of Safety, Solid-Fuel Type Room Heaters" • Washington State particulate air containment standard, WAC 173-433-100 (3) • ASTM E 1509-04, "Standard Specification for Room Heaters, Pellet Fuel-Burning Type" • National Fuel Gas Code, Section K.1.11
Garage Isolation		
5.3	Common walls and ceiling between an attached garage and living space shall be completely sealed before insulation is installed.	• EEBA Builder Guides
5.4	All connecting doors between living space and garage shall include an automatic closer, and shall be gasketed or made substantially air-tight with weather stripping.	• ASHRAE 62.2 (6.5)
5.5	Garages shall have an ENERGY STAR qualified 100 cfm exhaust ventilation fan venting to outdoors, designed for continuous operation.	• International Mechanical Code (2003), 403.3

5. Combustion Systems Required Measures (continued)		Reference(s)
Carbon Monoxide Alarms		
5.6	All homes with combustion appliance(s) shall have one carbon monoxide (CO) alarm installed outside of each separate sleeping area. They shall be placed according to National Fire Protection Association (NFPA) 720, Recommended Practice, "Installation of Household Carbon Monoxide (CO) Warning Equipment," and be hard-wired with a battery back-up function. The alarm devices shall be certified by either the Canadian Standards Association, CSA 6.19-01, or Underwriters Laboratory UL 2034.	• NFPA 720 • CSA 6.19-01, Standard for Residential CO Alarms • UL 2034, Standard for Single and Multiple Station CO Alarms

6. Building Materials Required Measures		Reference(s)
Preparation		
6.1	Building materials stored on site shall be protected from exposure to rain. Materials wetted during the construction process shall be allowed to dry before closing in building assembly.	• American Plywood Association
6.2	No construction debris shall be discarded and closed inside any wall assembly.	
Installation		
6.3	Raise paper covered gypsum board ½ inch above concrete slabs.	
6.4	Prime painted siding and trim made of wood or processed wood on all six sides. **Exception**: In areas with less than 20" of average annual rainfall, edge priming is not required.	• EEBA Builder Guide
6.5	Ventilate home during and shortly after installing products that are known sources of contaminants.	
Materials		
6.6	Structural plywood conforming to PS1 And PS2 and oriented strand board shall be made with exterior-type adhesives. Exterior-type adhesive is evidence by the appearance of "Exposure 1" or "Exterior" in the panel trademark.	• American Plywood Association
6.7	Particleboard and medium density fiberboard (MDF) shall be certified compliant with ANSI A208.1 and A208.2, respectively.	• American Plywood Association • ANSI A208.1 and A208.2
6.8	Hardwood plywood shall be compliant with ANSI/HPV AHP-1-2004 and U.S. HUD Standard 24, Part 3280.	• American Plywood Association • ANSI/HPV AHP-1-2004 • U.S. HUD Std. 24, Part 3280
6.9	Carpets and carpet adhesives shall carry the Carpet & Rug Institute (CRI) Green Label Plus low-emitting product label.	• Carpet and Rug Institute
6.10	Wall-to-wall carpet shall not be installed in bathrooms, kitchens, entryways, and utility rooms.	
6.11	Permeability rating of finishes used on the interior side of a home's exterior walls in hot humid or humid mixed climates shall be greater than '1'.	

7. Home Commissioning Required Measures		Reference(s)
Final Preparation		
7.1	Inspect air-handling equipment and verify: • equipment is generally free of debris and clean; • heat exchanger and coils in air-handler are free of dust created by construction activities (e.g., drywall, floor sanding); and • filter is new and clean, and matches specified MERV rating	
7.2	Inspect ductwork is clean, dry, and free of debris before installing registers, grilles, and diffusers.	
7.3	Inspect each supply and return point in the system to ensure that air is flowing and that there are no disconnects or large air gaps between boot and framed opening.	
7.4	Verify HVAC contractor has installed proper refrigerant charge with Evaporator Superheat Test, Subcooling Test, Weigh-in Refrigerant Test, or "CheckMe!" Test (or equivalent).	• Specification for Energy-Efficient Installation and Maintenance Practices for Residential HVAC Systems (Consortium for Energy Efficiency), p. 31-36 • "CheckMe!" test by Proctor Engineering
7.5	During the period between finishing and occupancy, ventilate the building with outside air at the highest rate the ventilation system can produce, meeting Section 4 Ventilation requirements for outdoor air flow and humidity control (4.16).	•
7.6	Provide owners of homes in U.S. EPA Zone 1 and Zone 2 radon areas two radon test kits designed for 48-hour exposures, including instructions for use and guidance for follow-up actions to testing results.	• U.S. Environmental Protection Agency guidance document entitled "Building Radon Out", document #EPA/402-K-01-002, available through EPA's web site: www.epa.gov/iaq/radon/pubs
Owner's Checklist/Manual		
7.7	Provide a checklist listing all required measures from this specification along with the signature of official representative of builder indicating full compliance with the checklist.	
7.8	Provide home owner's manual including at a minimum documentation on all special equipment with instructions for proper operation and maintenance, and HVAC load calculations.	